

REMARKS

Reconsideration of this application, based on this amendment and these following remarks, is respectfully requested.

Claims 1 through 7 and 11 through 15 are now in this case. Claims 8 through 10 are canceled. Claims 11 through 15 are added.

The specification is amended to address the informality noted by the Examiner, and to correct an error of a typographical nature relative to a reference numeral. No new matter is submitted by this amendment.

The drawings are amended to insert the "PRIOR ART" designation in Figures 1 and 2, which the Examiner found lacking. Applicant submits that this amendment to the drawings overcomes the objection to the drawings.

Applicant notes the objection to claim 2, as depending on a rejected claim, and also notes the Examiner's finding that this claim is directed to allowable subject matter.

Claims 1 and 3 through 10 were rejected under §103 as unpatentable over the Uchiyama reference¹. The Examiner asserted that the reference discloses its units 6 through 15 which "act as a tracking buffer", the centering of the plurality of coefficients in the equalizer, filtering the signal with the plurality of coefficients, and the updating of the plurality of coefficients in the equalizer.² The Examiner admitted that the Uchiyama reference does not disclose the updating and centering of the plurality of the coefficients in the tracking buffer rather than in the equalizer, but asserted that this difference is no more than an obvious design choice.³

Applicant respectfully traverses the §103 rejection of claim 1, on the grounds that the rejection is based on a misinterpretation of the reference.

¹ U.S. Patent No. 5,228,060, issued July 13, 1993 to Uchiyama.

² Office Action of November 6, 2003, pages 2 and 3.

³ *Id.*

Claim 1 is directed to a method for timing recovery of a digital signal in a telecommunications receiver. In the claimed method, the digital signal is filtered through an equalizer, with a plurality of coefficients. The method requires tracking the plurality of coefficients in a tracking buffer for timing drift, and centering the plurality of coefficients in that tracking buffer. As described in the specification, this method provides the important advantages of ensuring that the largest coefficients remain centered and do not migrate out of the filter, even as an adaptive equalizer updates the coefficients.⁴ Improved fidelity and reliability in the receipt of digital communications signals is thus provided.

Referring to the rejection of claim 1, Applicant submits that the reference fails to teach the centering of coefficients in an equalizer, contrary to the assertion by the Examiner. The Examiner cited a particular location of the Uchiyama reference⁵ as teaching the centering of coefficients in the equalizer. However, that particular location of the reference fails to disclose centering a plurality of coefficients at all. Rather, that location of the reference discloses the determining of an evaluation parameter $Ter(k)$ which is the difference between successive coefficient ratios of the center tap coefficient to a next tap in the equalizer; this evaluation parameter can indicate a sudden phase shift.⁶ That location of the reference also discloses another evaluation parameter $Cer(k)$ corresponding to the difference between each equalizer coefficient at a time k and a corresponding coefficient at the previous time $k-1$. However, nowhere does this portion of the specification disclose the centering of coefficients, much less the centering step of claim 1, even if one were to accept that the reference teaches a tracking buffer (which is questionable, at best). Accordingly, Applicant submits that the rejection is in error, as based on a faulty interpretation of the Uchiyama reference.

Applicant further respectfully submits that claim 1 is patentably distinct over the Uchiyama reference, on the grounds that the teachings of the applied reference falls short of the requirements of the claim, and that there is no suggestion from the prior art or otherwise to modify the teachings of the reference in such a manner as to reach the claim.

⁴ Specification of S.N. 09/713,580, page 6, line 2 through page 7, line 2.

⁵ Uchiyama, *supra*, column 5, line 67 through column 6, line 15.

⁶ *Id.*

For the reasons discussed above, the Uchiyama reference fails to disclose the centering step of claim 1. Applicant submits that there is no suggestion to modify the teachings of the reference to provide this centering step, thus reaching the claim. This lack of suggestion is especially apparent given the significant difference between the purpose and function of the system disclosed in the Uchiyama reference and that of the invention of claim 1.

The purpose of the Uchiyama system is to detect a "disturbance" in the incoming signal, and to ensure that the adaptive equalizer coefficients are not modified by the disturbance to such a divergent extent that the modem hangs up.⁷ According to the Uchiyama teachings, upon detecting a disturbance in the signal, the previous state of the equalizer is maintained, and used again once the disturbance is over.⁸ Timing recovery is accomplished in the Uchiyama system by adjusting the timing of its analog-to-digital converter,⁹ in a manner that is quite similar to the conventional approach described in this application relative to its Figure 1.¹⁰

On the other hand, the purpose and effect of the method of claim 1 is to ensure that adaptive equalizer coefficients remain substantially centered within the equalizer, even in the face of timing drift between the transmitter and receiver, which can cause the adaptively adjusted equalizer coefficients to drift one way or the other.¹¹ In the method of claim 1, this is accomplished by tracking and centering the plurality of coefficients in the tracking buffer.

It is therefore readily apparent that the Uchiyama reference itself nowhere suggests modifying its own teachings by including a step of centering the plurality of coefficients, as required by claim 1. The Uchiyama reference handles timing drift in the conventional way, and, to the extent that it does teach management of the equalizer coefficients, its intent is to inhibit modifying those coefficients in the event of a brief signal disturbance. Accordingly, any suggestion to modify the teachings of the Uchiyama reference in such a manner as to reach claim 1 is necessarily based on the improper use of Applicant's own teachings in hindsight.

⁷ Uchiyama, *supra*, column 3, lines 39 through 51.

⁸ Uchiyama, *supra*, column 5, lines 36 through 46.

⁹ Uchiyama, *supra*, column 4, lines 39 through 49.

¹⁰ Specification, *supra*, page 3, line 22 through page 4, line 14; Figure 1.

¹¹ Specification, *supra*, page 6, line 2 through page 7, line 2.

For these reasons, Applicant traverses the §103 rejection of claim 1, and submits that the claim is patentably distinct over the applied prior art.

Claims 3 and 4 were rejected, under §103, on the grounds that the Uchiyama reference discloses the centering of the plurality of coefficients in the equalizer, and that the splitting of the signal into in-phase and quadrature-phase signals would be obviously apparent from the reference.¹²

Applicant also respectfully traverses the rejection of claims 3 and 4, on the grounds that the reference falls short of the requirements of claim 3, and that there is no suggestion to modify the teachings of the reference to reach the claim.

Claim 3 is directed to a method for timing recovery, in which the incoming digital signal is split into in-phase and quadrature input signals, and are filtered through in-phase and quadrature equalizers, respectively. The claim further requires tracking, for timing drift and in a tracking buffer, a plurality of in-phase coefficients used in the in-phase equalizer, and centering these in-phase coefficients (as well as the quadrature coefficients) in the tracking buffer. Claim 4 further recites, relative to claim 3 upon which it depends, the tracking of the quadrature coefficients in the tracking buffer. The method of claims 3 and 4 provide similar advantages as discussed above relative to claim 1, ensuring that the largest coefficients remain centered and do not migrate out of the filter, even as an adaptive equalizer updates the coefficients for timing drift.

Similarly as argued above relative to claim 1, Applicant submits that the Uchiyama reference does not disclose the centering of a plurality of in-phase and quadrature-phase coefficients in any element, much less in a tracking buffer as required by claim 3. Again, the cited location of the reference fails to disclose the centering of any coefficients in an equalizer or otherwise. Instead, the Uchiyama reference teaches, at the cited location, the calculation of various evaluation parameters that indicate a disturbance in the incoming received signal. No centering of coefficients is disclosed at that location, nor is such centering disclosed elsewhere in

¹² Office Action, *supra*, pages 3 and 4.

the reference. For this reason, Applicant submits that the rejection of claim 3 is in error, and that the Uchiyama reference falls short of the requirements of claim 3 by its failure to disclose the recited centering steps.

Also as discussed above relative to claim 1, Applicant further respectfully submits that claims 3 and 4 are patentably distinct over the Uchiyama reference, on the grounds that the teachings of the applied reference falls short of the requirements of the claims, and that there is no suggestion to modify these teachings of the reference in such a manner as to reach the claims.

As discussed above, the Uchiyama reference lacks disclosure of the centering steps of claim 3. Applicant submits that there is no suggestion to modify the teachings of the reference in such a manner as to reach the claims, considering that the Uchiyama reference is directed to the inhibiting of the modification of the adaptive equalizer coefficients in the event of a "disturbance" in the incoming signal, and teaches the storing of the equalizer state upon detecting such a disturbance and using this stored state once the disturbance is over. To the extent that timing recovery is disclosed in the Uchiyama reference, the reference teaches adjusting the timing of its analog-to-digital converter, similarly as the conventional approach shown in Figure 1 of this application. In contrast, the method of claims 3 and 4 ensures that the adaptive equalizer coefficients remain substantially centered within the equalizer, even in the face of timing drift between the transmitter and receiver, by way of the recited tracking and centering steps.

It is therefore readily apparent that the Uchiyama reference itself nowhere suggests modifying its own teachings by including a step of centering coefficients, as required by claim 3 and 4. Rather, the Uchiyama reference handles timing drift in the conventional way and, to the extent that it does teach management of the equalizer coefficients, its intent is to inhibit modifying those coefficients in the event of a brief signal disturbance. Accordingly, any suggestion to modify the teachings of the Uchiyama reference in such a manner as to reach claims 3 and 4 must only come from the improper use of Applicant's own teachings in hindsight.

For these reasons, Applicant submits that claims 3 and 4 are patentably distinct over the Uchiyama reference.

Claim 5 was rejected under §103, on the grounds that the Uchiyama reference discloses all of the elements of the claim, including buffer manager 8 (allegedly corresponding to the buffer manager of claim 5) that shifts coefficients to remain centered in the equalizer. The Examiner states that the reference does not disclose the shifting of the coefficients in a tracking buffer, rather than the equalizer, but that this difference amounts to design choice.¹³

Applicant respectfully traverses the rejection of claim 5, on the grounds that it is based on a misinterpretation of the reference.

As stated above, Applicant respectfully submits that the Uchiyama reference does not teach centering of the coefficients in an equalizer, in a tracking buffer, or in any element. Instead, the cited location of the reference teaches the calculation of evaluation parameters to determine whether a disturbance is present in the incoming signal. For purposes of timing recovery, the reference teaches the conventional approach of adjusting the clock of its analog-to-digital converter, and nowhere discloses the centering of its equalizer coefficients. Accordingly, Applicant respectfully submits that the §103 rejection of claim 5 and its dependent claims is based on a misinterpretation of the reference, and is in error.

Applicant further respectfully submits that there is no suggestion to modify the teachings of the Uchiyama reference in such a manner as to reach claim 5. This lack of suggestion is clearly apparent from the divergent purpose of the Uchiyama teachings (*i.e.*, to inhibit updating of the adaptive equalizer coefficients because of a disturbance) from the purpose of the claimed invention (*i.e.*, to maintain the adaptive equalizer coefficients centered within the filter). This lack of coherence in purpose negates any suggestion to modify the teachings of the reference, especially without reference to any other prior art, except by the improper hindsight application of Applicant's own teachings.

¹³ Office Action, *supra*, page 4.

Applicant therefore respectfully submits that claims 5 through 7 are patentably distinct over the Uchiyama reference.

Claims 8 through 10 are canceled, obviating the §103 rejection of these claims.

Claims 11 through 15 are added to more completely claim all aspects of Applicant's invention.

New independent apparatus claim 11 is directed to a receiver, comprised of an analog-to-digital converter, an adaptive equalizer, a tracking buffer, and buffer management circuitry. The recited buffer management circuitry tracks movement, within the tracking buffer, of the position of those filter coefficients having the highest values, and shifts the position of the sequence of filter coefficients within the tracking buffer, so that those filter coefficients having the highest values are in a central portion of the sequence of coefficients. The specification of this application clearly supports this new claim,¹⁴ and therefore no new matter is presented by this claim.

Claims 12 through 14 further recite, relative to claim 11 upon which they depend, the particular structures of a data sample tracking buffer, for storing data samples including the sequence of digital samples, and a tap weight tracking buffer, for storing filter coefficients including the sequence of filter coefficients. The specification clearly supports these additional elements, and the alternative manner of their implementation as recited in claims 13 and 14,¹⁵ and as such no new matter is presented by these new claims. Claim 15 further recites, relative to claim 11 upon which it depends, the in-phase and quadrature-phase equalizers and coefficients; no new matter is presented by claim 15.¹⁶

Applicant respectfully submits that new claim 11 and its dependent claims are all patentably distinct over the Uchiyama reference.

¹⁴ Specification, *supra*, page 13, line 15 through page 17, line 23.

¹⁵ Specification, *supra*, page 13, line 15 through page 14, line 4; Figures 6, 7a, and 7b.

¹⁶ See specification, *supra*, page 13, line 15 through page 17, line 23.

Claim 11 requires that the buffer management circuitry tracks the movement of the position of the filter coefficients having the highest values within the tracking buffer, and shifts the position of the sequence of filter coefficients within the tracking buffer so that those coefficients having the highest values are in a center portion of the sequence. There is no disclosure of such tracking and shifting in the Uchiyama reference; rather, the reference teaches timing recovery by conventional adjustment of the clock applied to the analog-to-digital converter. Further, considering the difference in purpose and function between the Uchiyama teachings and that of claims 11 through 15, Applicant submits that there is no suggestion to modify the Uchiyama teachings in such a manner as to reach the claims.

Applicant therefore respectfully submits that new claims 11 through 15 are patentably distinct over the Uchiyama reference.

The prior art cited by the Examiner as pertinent, but not applied against the claims, has been considered but is not felt to come within the scope of the claims in this case.

For the above reasons, Applicant respectfully submits that all claims now in this case are in condition for allowance. Reconsideration of this application is therefore respectfully requested.

Respectfully submitted,



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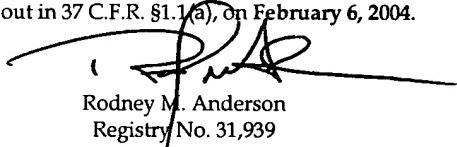
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37 C.F.R. 1.8

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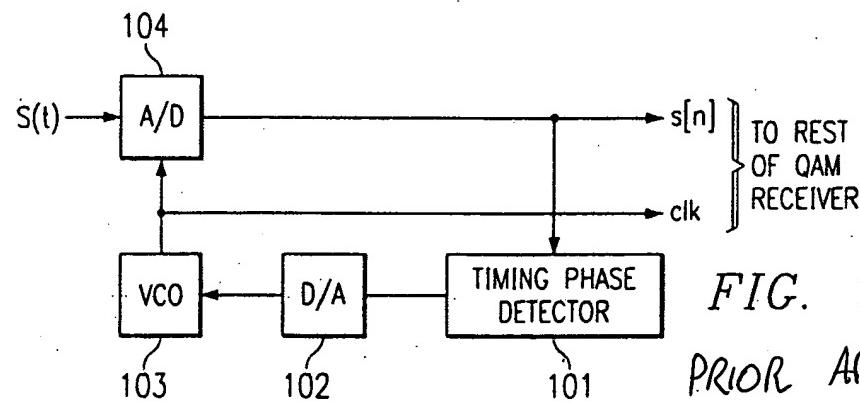


FIG. 1
PRIOR ART

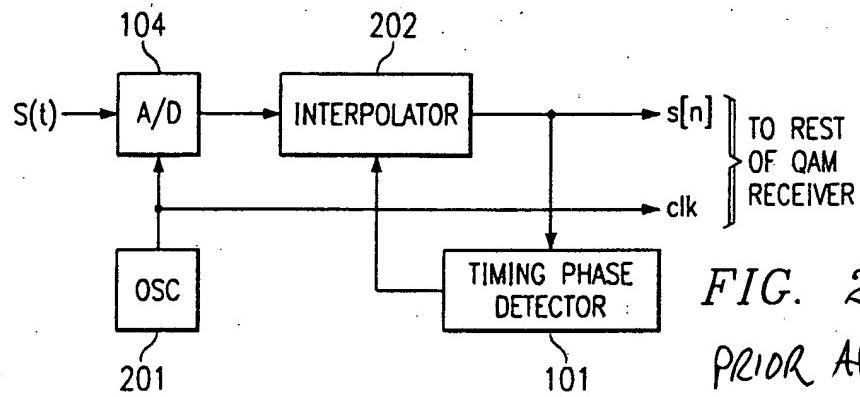


FIG. 2
PRIOR ART

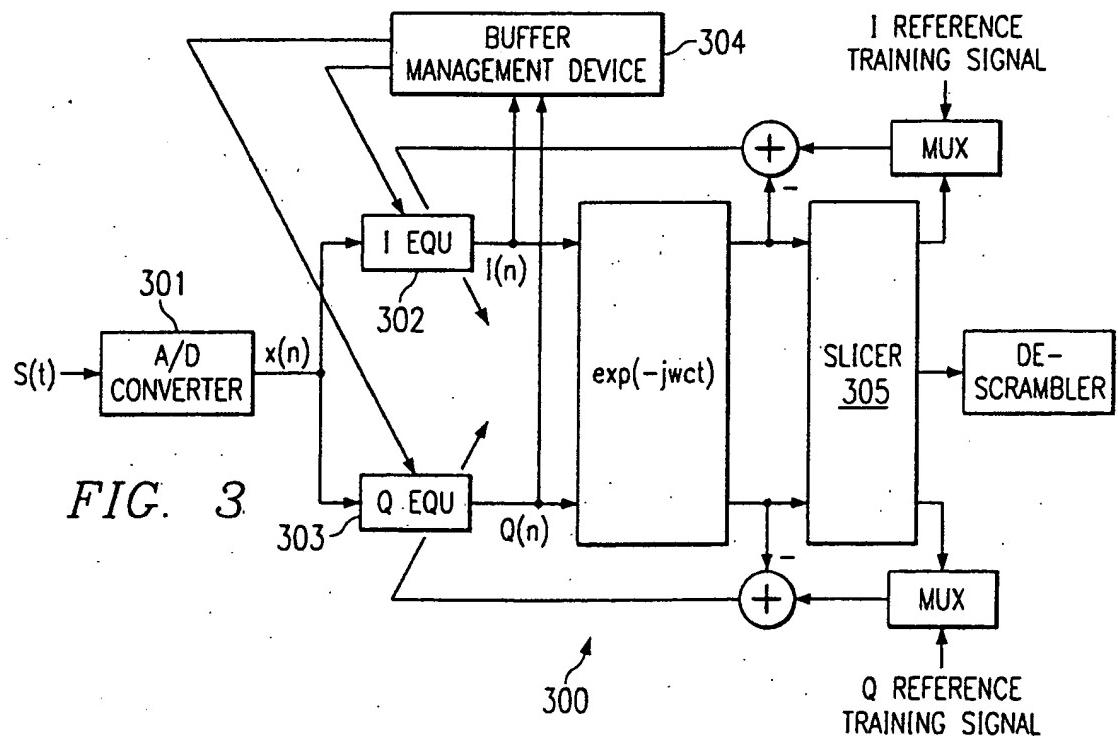


FIG. 3